

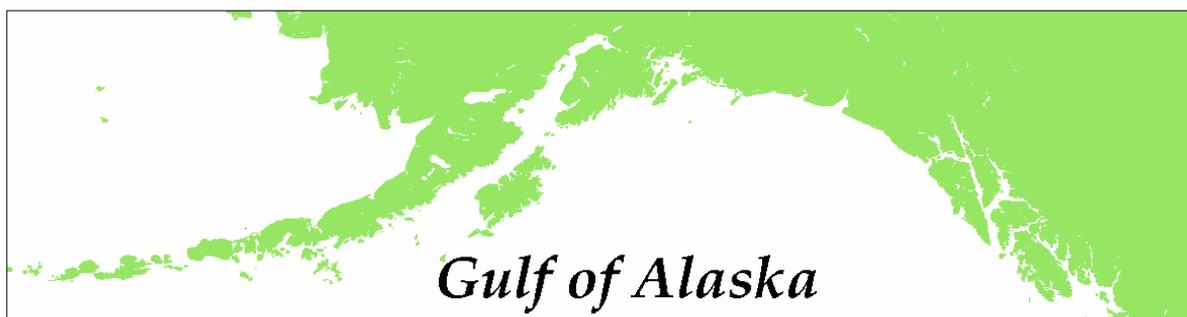
## APPENDIX B

### STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

#### FOR THE GROUND FISH RESOURCES OF THE GULF OF ALASKA

Compiled by

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with contributions by

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# Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska

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# Summary

by

The Plan Team for the Groundfish Fisheries of the Gulf of Alaska

## Introduction

The *National Standard Guidelines for Fishery Management Plans* published by the National Marine Fisheries Service (NMFS) require that a stock assessment and fishery evaluation (SAFE) report be prepared and reviewed annually for each fishery management plan (FMP). The SAFE reports are intended to summarize the best available scientific information concerning the past, present, and possible future condition of the stocks and fisheries under federal management. The FMPs for the groundfish fisheries managed by the Council require that drafts of the SAFE reports be produced each year in time for the December North Pacific Fishery Management Council (Council) meetings.

The SAFE report for the Gulf of Alaska (GOA) groundfish fisheries is compiled by the Plan Team for the Gulf of Alaska Groundfish FMP from chapters contributed by scientists at NMFS Alaska Fisheries Science Center (AFSC) and the Alaska Department of Fish and Game (ADF&G). The stock assessment section includes recommended acceptable biological catch (ABC) levels for each stock and stock complex managed under the FMP. The ABC recommendations, together with social and economic factors, are considered by the Council in determining total allowable catches (TACs) and other management strategies for the fisheries.

The GOA Groundfish Plan Team met in Seattle on November 13-17<sup>th</sup>, 2006 to review the status of stocks of seventeen species or species groups that are managed under the FMP. The Plan Team review was based on presentations by ADF&G and NMFS AFSC scientists with opportunity for public comment and input. Members of the Plan Team who compiled the SAFE report were James Ianelli and Diana Stram (co-chairs), Sandra Lowe, Jeff Fujioka, Jon Heifetz, Ken Goldman, Bob Foy, Bill Clark, Sarah Gaichas, Victoria O'Connell, Tom Pearson, Nick Sagalkin, and Dan Lew.

## Background Information

### *Management Areas and Species*

The Gulf of Alaska (GOA) management area lies within the 200-mile U.S. Exclusive Economic Zone (EEZ) of the United States (Figure 1). Five categories of finfishes and invertebrates have been designated for management purposes. They are: target species, other species, prohibited species, forage fish species and non-specified species. This SAFE report describes stock status of target species only. Species or complexes included in each of the first three categories are listed below.

<b>Target Species</b>	<b>Other Species</b>	<b>Prohibited Species</b>
Pollock	Octopus	Pacific halibut
Pacific cod	Squids	Pacific herring
Flatfishes	Sculpins	Pacific salmon
Rockfishes	Sharks	Steelhead trout
Sablefish		King crabs
Atka mackerel		Tanner crabs
Skates		

A species or species group from within the target species category may be split out and assigned an appropriate harvest level. Similarly, species in the target species category may be combined and a single harvest level assigned to the new aggregate species group. The harvest level for demersal shelf rockfish in the Eastern Regulatory Area is specified by the Council each year. However, management of this fishery is deferred to the State of Alaska with Council oversight. All other species of fish and

invertebrates taken incidentally that are not managed by other FMPs and are associated with groundfish fisheries are designated as “non-specified species” and catch reporting is not required.

The GOA FMP recognizes single species and species complex management strategies. Single species specifications are set for stocks individually, recognizing that different harvesting sectors catch an array of species. In the Gulf of Alaska these species include Pacific cod, pollock, sablefish, Pacific ocean perch, thornyhead rockfish, flathead sole, rex sole, arrowtooth flounder, northern rockfish, rougheye rockfish, shortraker rockfish, Atka mackerel, big skates, and longnose skates. Other groundfish species that are usually caught in groups have been managed as complexes (also called assemblages). For example, other slope rockfish, pelagic shelf rockfish, demersal shelf rockfish, deep water flatfish, shallow water flatfish, other skates, and “other species” have been managed within complexes.

The FMP authorizes splitting species, or groups of species, from the complexes for purposes of promoting the goals and objectives of the FMP. Atka mackerel was split out from “other species” beginning in 1994. In 1998, black and blue rockfish were removed from the GOA FMP and management was deferred to ADF&G. Beginning in 1999, osmerids (eulachon, capelin and other smelts) were removed from the “other species” category and placed in a separate forage fish category. In 2004, Amendment 63 to the FMP was approved which moved skates from the other species category into a target species category whereby individual OFLs and ABCs for skate species and complexes could be established.

Groundfish catches are managed against TAC specifications for the EEZ and near coastal waters of the GOA. State of Alaska internal water groundfish populations are typically not covered by NMFS surveys and catches from internal water fisheries generally not counted against the TAC. The Team has recommended that these catches represent fish outside of the assessed region, and should not be counted against an ABC or TAC. Beginning in 2000, the pollock assessment incorporated the ADF&G survey pollock biomass, therefore, the Plan Team acknowledged that it is appropriate to reduce the Western (W), Central (C) and West Yakutat (WY) combined GOA pollock ABC by the anticipated Prince William Sound (PWS) harvest level for the State fishery. Therefore, the 2007 PWS GHF of 1,650 mt should be deducted from the W/C/WY pollock ABC before area apportionments are made.

The Plan Team has provided subarea ABC recommendations on a case by case basis since 1998 based on the following rationale. The Plan Team recommended splitting the EGOA ABC for species/complexes that would be disproportionately harvested from the West Yakutat area by trawl gear. The Team did not split EGOA ABCs for species that were prosecuted by multi-gear fisheries or harvested as bycatch. For those species where a subarea ABC split was deemed appropriate, two approaches were examined. The point estimate for WY biomass distribution based on survey results was recommended for seven species/complexes to determine the WY and East Yakutat/Southeast Outside subarea ABC splits. For some species/complexes, a range was recommended bounded by the point estimate and the upper end of the 95% confidence limit from all three surveys. The rationale for providing a range was based on a desire to incorporate the variance surrounding the distribution of biomass for those species/complexes that could potentially be constrained by the recommended ABC splits.

<b>No Split</b>	<b>Split, Point Estimate</b>	<b>Split, Upper 95% CI</b>
Pacific cod	Pollock	Pacific ocean perch
Atka mackerel	Sablefish	Pelagic shelf rockfish
Shortraker/rougheye	Deep-water flatfish	
Thornyhead	Shallow-water flatfish	
Northern rockfish	Rex sole	
Demersal shelf rockfish	Arrowtooth flounder	
All skates	Flathead sole	
	Other slope rockfish	

## ***New data summary***

Since the Stock Assessment and Fishery Evaluation Report (SAFE) for 2006 was issued (NPFMC 2005), the following new information has been incorporated in the stock assessments:

- 1) Pollock: (a) preliminary catch estimates for the 2006 fishery, (b) age composition from the 2005 fishery; (c) biomass and age composition from the 2006 Shelikof Strait echo integration trawl (EIT) survey; (d) 2005 age composition from the NMFS bottom trawl survey, and e) 2006 biomass and length composition from the ADF&G crab/groundfish trawl survey.
- 2) Pacific cod: (a) size composition data from the 2005 and preliminary estimates for the 2006 fisheries; (b) age composition data from the 2005 GOA bottom trawl survey; c) length-at-age data from the 2005 GOA bottom trawl survey; d) parameters governing the length-at-age and weight-at-length relationships were re-estimated based on all available data from the NMFS bottom trawl survey time series.
- 3) Sablefish: (a) relative abundance and length data from the 2006 longline survey, (b) relative abundance and length data from the 2005 longline and trawl fisheries, (c) age data from the 2005 longline survey and longline fisheries, and d) survey abundance and length data from GOA bottom trawl surveys.
- 4) Flatfish: Flatfish have been moved to a biennial stock assessment schedule to coincide with new survey data. Executive summaries only are presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. The only new information that is updated in the projections is the 2005 catch and the best estimate of 2006 catch.
- 5) Rex sole: Rex sole has been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. The only new information that is updated in the projections is the 2005 catch and the best estimate of 2006 catch.
- 6) Arrowtooth flounder: Arrowtooth flounder has been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. The only new information that is updated in the projections is the 2005 catch and the best estimate of 2006 catch.
- 7) Flathead sole: Flathead sole has been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. The only new information that is updated in the projections is the 2005 catch and the best estimate of 2006 catch.
- 8) Pacific ocean perch: Pacific ocean perch has been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. The only new information that is updated in the projections is the 2005 catch and the best estimate of 2006 catch.
- 9) Northern rockfish (full assessment): a) Updated fishery age compositions from a backlog of available otoliths for the years 2000-2002; b) 2005 trawl survey age compositions; c) estimates of historical catch for the years 1961-1976, and d) updated von Bertalanffy age-length relationship and resulting age-length transition matrix. Nine model runs were presented to evaluate sensitivity to model assumptions and the relative contributions of different data components, with author recommended Model 2 representing a simplification

of last year's reference model by removal of the stock recruitment relationship and modeling selectivity as a logistic rather than smoothed penalty function.

- 10) Rougeye rockfish: Rougeye has been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. The only new information that is updated in the projections is the 2005 catch and the best estimate of 2006 catch. Two appendices are attached to the executive summary: Appendix 10A Sensitivity of trawl and longline surveys, and Appendix 10B Separate species of rougeye rockfish.
- 11) Shortraker and other slope rockfish: Shortraker and other slope rockfish have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. There is no new information for these species which are in Tiers 4-5. Data from the three most recent trawl surveys were used to determine the 2006 ABCs and OFLs for this group. Therefore, for both shortraker and the other slope rockfish, last year's stock assessment estimates are rolled over for 2007 and 2008.
- 12) Pelagic shelf rockfish: Pelagic shelf rockfish have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. The only new information that is updated in the projections for dusky rockfish is the 2005 catch and the best estimate of 2006 catch. There is no new information for dark, widow, and yellowtail rockfish, and last year's stock assessment estimates are rolled over for 2007 and 2008.
- 13) Demersal shelf rockfish: Demersal shelf rockfish have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. There is no new information for demersal shelf rockfish, and last year's stock assessment estimates are rolled over for 2007 and 2008. In response to SSC comments, information about full retention, the commercial halibut fishery DSR catch, and the recreational fishery is presented.
- 14) Thornyheads: Thornyheads have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. There is no new information for thornyhead rockfish which are in Tier 5, and last year's stock assessment estimates are rolled over for 2007 and 2008.
- 15) Atka mackerel: Atka mackerel have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. Age composition from the 2005 GOA bottom trawl survey are presented. However, there is no new information for projections for Atka mackerel which are in Tier 6, and last year's stock assessment estimates are rolled over for 2007 and 2008.
- 16) Skates: Skates have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. Updated life history information based on recently completed studies are presented. However, there is no new information for projections for skates which are in Tier 5, and last year's stock assessment estimates are rolled over for 2007 and 2008.
- 17) Groundfish, generally: Updated catch data from the NMFS Observer Program and Regional Office for 2005 and through November 4<sup>th</sup>, 2006.

- 18) Other species: incidental catch is included for TAC recommendations. Preliminary stock assessments are included for a number of species groups for forthcoming break-out Plan Amendment analyses.

### **Biological Reference Points**

A number of biological reference points are used in this SAFE. Among these are the fishing mortality rate ( $F$ ) and stock biomass level ( $B$ ) associated with MSY ( $F_{MSY}$  and  $B_{MSY}$ , respectively). Fishing mortality rates reduce the level of spawning biomass per recruit to some percentage  $P$  of the pristine level ( $F_{P\%}$ ). The fishing mortality rate used to compute ABC is designated  $F_{ABC}$ , and the fishing mortality rate used to compute the overfishing level (OFL) is designated  $F_{OFL}$ .

### **Definition of Acceptable Biological Catch and the Overfishing Level**

Amendment 56 to the GOA Groundfish FMP, approved by the Council in June 1998, defines ABC and OFL for the GOA groundfish fisheries. The new definitions are shown below, where the fishing mortality rate is denoted  $F$ , stock biomass (or spawning stock biomass, as appropriate) is denoted  $B$ , and the  $F$  and  $B$  levels corresponding to MSY are denoted  $F_{MSY}$  and  $B_{MSY}$  respectively.

<b>Tier</b>	<ol style="list-style-type: none"> <li>1) Information available: <i>Reliable point estimates of <math>B</math> and <math>B_{MSY}</math> and reliable pdf of <math>F_{MSY}</math>.</i> <ol style="list-style-type: none"> <li>1a) Stock status: <math>B/B_{MSY} &gt; 1</math>  <math>F_{OFL} = \mu_A</math>, the arithmetic mean of the pdf  <math>F_{ABC} \leq \mu_H</math>, the harmonic mean of the pdf</li> <li>1b) Stock status: <math>\alpha &lt; B/B_{MSY} \leq 1</math>  <math>F_{OFL} = \mu_A \times (B/B_{MSY} - \alpha)/(1 - \alpha)</math>  <math>F_{ABC} \leq \mu_H \times (B/B_{MSY} - \alpha)/(1 - \alpha)</math></li> <li>1c) Stock status: <math>B/B_{MSY} \leq \alpha</math>  <math>F_{OFL} = 0</math>  <math>F_{ABC} = 0</math></li> </ol> </li> <li>2) Information available: <i>Reliable point estimates of <math>B</math>, <math>B_{MSY}</math>, <math>F_{MSY}</math>, <math>F_{35\%}</math>, and <math>F_{40\%}</math>.</i> <ol style="list-style-type: none"> <li>2a) Stock status: <math>B/B_{MSY} &gt; 1</math>  <math>F_{OFL} = F_{MSY}</math>  <math>F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%})</math></li> <li>2b) Stock status: <math>\alpha &lt; B/B_{MSY} \leq 1</math>  <math>F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)</math>  <math>F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)</math></li> <li>2c) Stock status: <math>B/B_{MSY} \leq \alpha</math>  <math>F_{OFL} = 0</math>  <math>F_{ABC} = 0</math></li> </ol> </li> <li>3) Information available: <i>Reliable point estimates of <math>B</math>, <math>B_{40\%}</math>, <math>F_{35\%}</math>, and <math>F_{40\%}</math>.</i> <ol style="list-style-type: none"> <li>3a) Stock status: <math>B/B_{40\%} &gt; 1</math>  <math>F_{OFL} = F_{35\%}</math>  <math>F_{ABC} \leq F_{40\%}</math></li> <li>3b) Stock status: <math>\alpha &lt; B/B_{40\%} \leq 1</math>  <math>F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)</math>  <math>F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)</math></li> <li>3c) Stock status: <math>B/B_{40\%} \leq \alpha</math>  <math>F_{OFL} = 0</math>  <math>F_{ABC} = 0</math></li> </ol> </li> <li>4) Information available: <i>Reliable point estimates of <math>B</math>, <math>F_{35\%}</math>, and <math>F_{40\%}</math>.</i>  <math>F_{OFL} = F_{35\%}</math>  <math>F_{ABC} \leq F_{40\%}</math></li> <li>5) Information available: <i>Reliable point estimates of <math>B</math> and natural mortality rate <math>M</math>.</i>  <math>F_{OFL} = M</math>  <math>F_{ABC} \leq 0.75 \times M</math></li> <li>6) Information available: <i>Reliable catch history from 1978 through 1995.</i>  <math>OFL =</math> the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information  <math>ABC \leq 0.75 \times OFL</math></li> </ol>
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Acceptable Biological Catch is a preliminary description of the acceptable harvest (or range of harvests) for a given stock or stock complex. Its derivation focuses on the status and dynamics of the stock, environmental conditions, other ecological factors, and prevailing technological characteristics of the fishery. The fishing mortality rate used to calculate ABC is capped as described under “overfishing” below.

Overfishing is defined as any amount of fishing in excess of a prescribed maximum allowable rate. This maximum allowable rate is prescribed through a set of six tiers which are listed below in descending order of preference, corresponding to descending order of information availability. The SSC will have final authority for determining whether a given item of information is reliable for the purpose of this definition, and may use either objective or subjective criteria in making such determinations. For tier (1), a pdf refers to a probability density function. For tiers (1-2), if a reliable pdf of  $B_{MSY}$  is available, the preferred point estimate of  $B_{MSY}$  is the geometric mean of its pdf. For tiers (1-5), if a reliable pdf of  $B$  is available, the preferred point estimate is the geometric mean of its pdf. For tiers (1-3), the coefficient  $\alpha$  is set at a default value of 0.05, with the understanding that the SSC may establish a different value for a specific stock or stock complex as merited by the best available scientific information. For tiers (2-4), a designation of the form “ $F_{X\%}$ ” refers to the  $F$  associated with an equilibrium level of spawning per recruit (SPR) equal to  $X\%$  of the equilibrium level of spawning per recruit in the absence of any fishing. If reliable information sufficient to characterize the entire maturity schedule of a species is not available, the SSC may choose to view SPR calculations based on a knife-edge maturity assumption as reliable. For tier (3), the term  $B_{40\%}$  refers to the long-term average biomass that would be expected under average recruitment and  $F=F_{40\%}$ .

## Overview of Stock Assessments

The current status of individual groundfish stocks managed under the FMP is summarized in this section. The abundances of Pacific cod, Dover sole, flathead sole, arrowtooth flounder, Pacific ocean perch, rougheye rockfish, northern rockfish, and dusky rockfish are above target stock size. The abundances of pollock and sablefish are below target stock size. The relative abundances of other deep-water flatfish, shallow-water flatfish, rex sole, shortraker rockfish, demersal shelf rockfish, other pelagic shelf rockfish, other slope rockfish, thornyhead rockfish, Atka mackerel, and skates are unknown.

## Summary and Use of Terms

Tables 1 and 2 provide a summary of the current status of the groundfish stocks, including catch statistics, ABCs, and TACs for 2006, and recommendations for ABCs and overfishing levels (OFLs) for 2007 and 2008. The added year was included to assist NMFS management since the TAC setting process allows for a period of up to two years to review harvest specifications. Fishing mortality rates ( $F$ ) and OFLs used to set these specifications are listed in Table 3. ABCs and TACs are specified for each of the Gulf of Alaska regulatory areas illustrated in Figure 1. Table 4 provides a list of species for which the ABC recommendations are below the maximum permissible. Table 5 provides historical groundfish catches in the GOA, 1956-2006.

The sum of the preliminary 2007, 2008 ABCs for target species are 490,327 mt (2007), 511,836 mt (2008) which are within the FMP-approved optimum yield (OY) of 116,000 - 800,000 mt for the Gulf of Alaska. The sum of 2007 and 2008 OFLs are 615,879 mt and 629,541 mt, respectively. The Team notes that because of halibut bycatch mortality considerations in the high-biomass flatfish fisheries, an overall OY for 2007 will be considerably under this upper limit. For perspective, the sum of the 2006 TACs was 292,776 mt, and the sum of the ABCs was 501,366 mt.

The following conventions in this SAFE are used:

- (1) “Fishing mortality rate” refers to the full-selection  $F$  (i.e., the rate that applies to fish of fully selected sizes or ages). A full-selection  $F$  should be interpreted in the context of the selectivity schedule to which it applies.

- (2) For consistency and comparability, “exploitable biomass” refers to projected age+ biomass, which is the total biomass of all cohorts greater than or equal to some minimum age. The minimum age varies from species to species and generally corresponds to the age of recruitment listed in the stock assessment. Trawl survey data may be used as a proxy for age+ biomass. The minimum age (or size), and the source of the exploitable biomass values are defined in the summaries. These values of exploitable biomass may differ from listed in the corresponding stock assessments if the technical definition is used (which requires multiplying biomass at age by selectivity at age and summing over all ages). In those models assuming knife-edge recruitment, age+ biomass and the technical definitions of exploitable biomass are equivalent.
- (3) The values listed as 2005 and 2006 ABCs correspond to the values (in mt) approved by NMFS. The Council TAC recommendations for pollock were modified to accommodate revised area apportionments in the measures implemented by NMFS to mitigate pollock fishery interactions with Steller sea lions and for Pacific cod removals by the State water fishery of not more than 25% of the Federal TAC. The values listed for 2007 and 2008 correspond to the Plan Team recommendations.
- (4) The exploitable biomass for 2005 and 2006 that are reported in the following summaries were estimated by the assessments in those years. Comparisons of the projected 2007 biomass with previous years’ levels should be made with biomass levels from the revised hindcast reported in each assessment.
- (5) The values used for 2007 and 2008 were either rolled over (typically for Tiers 4-6w) or based on projections. Note that projection values often assume catches and hence their values are likely to change (as are the Tiers 4-6 numbers when new data become available).

### ***Two year OFL and ABC Determinations***

Amendment 48 to the GOA groundfish FMP made two significant changes with respect to the stock assessment process. First, since new data during years when no groundfish surveys are conducted are limited, annual assessments are no longer required for some GOA species. These species include the rockfishes, flatfishes, and Atka mackerel. In 2005 a GOA groundfish survey was conducted therefore full assessments for all species are presented in that SAFE report (NPFMC 2005). The second significant change is that the proposed and final specifications can be specified for a period of up to two years. This requires providing ABC and OFL levels for 2007 and 2008. The projection model accommodates likely mortalities for future OFL and ABC calculations.

In September of this year, preliminary projections of ABC and OFL for 2007 and 2008 were made on the basis of last year’s stock assessments. In this SAFE report, the Plan Team has revised many of those projections (Table 1). Such revisions are typically due to the development of new models; collection of new catch, survey, age composition, or size composition data; or use of new methodology for recommending ABC.

In the case of stocks managed under Tier 3, 2007 and 2008 ABC projections are typically based on the output for Scenarios 1 or 2 from the standard projection model. Projections for 2007 OFL are based on the output for Scenario 6 from the standard projection model. Accurate projections for 2008 OFL, however, require a modification of Scenario 6, because Scenario 6 assumes that catch in each year of the projection will equal OFL. Because it is very likely that the actual catch in 2007 (or any year, for that matter) will be substantially less than OFL, projections of 2008 OFL were based on a modification of Scenario 6 in which projected catch for 2007 is fixed at the chapter author’s best estimate. For example, if the actual catch for a particular species is typically close to the ABC, the author might set 2007 catch equal to the recommended ABC. Alternatively, if the actual catch for a particular species is typically much less than ABC, the author might set the 2007 catch equal to the recent average catch.

In the case of stocks managed under Tiers 4-6, 2008 projections are set equal to the Plan Team’s recommended values for 2007.

The 2008 ABC and OFL values recommended in next year's SAFE report are likely to differ from this year's projections for 2008, for the same reasons that the 2007 projections in this SAFE report differ from those made in September.

### ***Ecosystem Considerations-Gulf of Alaska***

This overview has been added to emphasize the increased treatment of ecosystem considerations in annual SAFE reports. A general description of the ecosystems considerations chapter highlighting recent concerns and trends is summarized below. The explicit incorporation of ecosystem assessment data and modeling results in specific stock assessment chapters is also summarized. Additional information is available in individual stock assessment chapters and the ecosystem considerations chapter. The Plan Team requested that ecosystem models be incorporated into next years assessments for sablefish and arrowtooth flounder in addition to continuing the studies on GOA pollock.

The ecosystem considerations chapter consists of three sections: ecosystem assessment, ecosystem status indicators, and ecosystem-based management indices and information. The ecosystem assessment section, introduced in 2003, combines information from the stock assessment chapters with the two other sections of this chapter to summarize the climate and fishery effects.

New trends highlighted in the 2006 ecosystem considerations chapter include:

- Historical biomass reconstructions based on ecosystem model runs incorporating stock assessment results from 1960-2005 found that the predator load in GOA increased since late 1970s and is continuing to increase as a function of arrowtooth flounder biomass. In addition, reconstructions (Fig 5. in Ecosystem Safe) suggested that forage fish have decreased substantially in last 2 decades.
- Bering Sea spring months were colder, ice extent was further south, and the cold pool was more extensive in 2006.
- Steller sea lion adults and juveniles abundances stabilized in 2006 compared with previous years in GOA and eastern AI. Non-pup counts continued to decline in the western AI.

## Stock status summaries

### 1. *Walleye Pollock*

Status and catch specifications (mt) of pollock and projections for 2007 and 2008. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2007 and 2008 are those recommended by the Plan Team. Catch data are current through November 4, 2006. The W/C/WYK ABC for 2008 is projected assuming 2007 catch equals 81,300 mt. Similarly, the OFL value for 2008 assumes that the 2007 catch equals the 2007 OFL (87,220 mt). Note that the projections for 2008 are subject to change in 2007. The 2007 and 2008 ABCs are reduced by 1,650 mt to accommodate the anticipated Prince William Sound GHL.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
GOA	2005	765,180	153,030	91,710	91,710	80,086
	2006	635,732	118,309	86,547	86,547	72,396
	2007	861,072	95,429	68,307		
	2008		113,699	81,467		
W/C/WYK	2005	736,200	144,340	85,190	85,190	80,086
	2006	608,370	110,100	80,390	79,650	72,396
	2007	833,710	87,220	62,150		
	2008		105,490	75,310		
EYK/SEO	2005	28,980	8,690	6,520	6,520	0
	2006	27,362	8,209	6,157	6,157	0
	2007	27,362	8,209	6,157		
	2008		8,209	6,157		

The age-structured model developed using AD Model Builder and used for GOA pollock assessments in 1999-2005 is fundamentally unchanged. This year's pollock chapter features the following new data: (1) preliminary 2006 catch estimates, (2) age composition from the 2005 fishery; (3) biomass and age composition from the 2006 Shelikof Strait echo integration trawl (EIT) survey; (4) biomass and length composition from the 2006 ADF&G crab/groundfish trawl survey; and (5) 2005 bottom trawl survey age composition data.

The 2006 Shelikof Strait EIT survey biomass estimate was 13% less than the 2005 estimate. Biomass estimates of Shelikof Strait fish  $\geq 43$  cm (a proxy for spawning biomass) decreased by 10% from the 2005 estimate, primarily due to ageing of the relatively strong 1999 and 2000 year classes without significant recruitment of later year classes to the spawning population. The estimate of age-2 abundance in Shelikof Strait indicates that the 2004 year class may be above average. The 2006 ADF&G crab/groundfish survey biomass estimate decreased 13% from 2005.

While there were no additions to the pollock stock assessment ecosystem considerations section this year, pertinent information for GOA pollock was presented within the Ecosystem Considerations Section (SAFE Appendix C). A new analysis conducted with the GOA ecosystem model compared estimates of predation mortality and fishing mortality relative to population production in order to determine whether total mortality exceeded production. The results suggested that high predation mortality plus conservative fishing mortality might exceed GOA pollock production at present (Ecosystem SAFE Figure 9), and that this condition may have been in place since the late 1980's or early 1990s (Ecosystem SAFE Figure 7). Although this analysis was considered preliminary by the ecosystem assessment authors, the Plan Team felt that it provided additional support for continued precautionary management of GOA pollock.

The Plan Team concurred with the author's choice to use the same model as last year to provide assessment advice. This model fixed trawl survey catchability (q) at 1.0 and estimated other catchabilities. Although the likelihood is higher for models with q closer to 0.8, the change in likelihood

is small (less than 1) between models with q fixed at 1.0 or estimated. Fixing q at 1.0 results in a more precautionary estimate of spawning biomass and therefore ABC than other models. Furthermore, identical to last year, the Plan Team accepted the author's recommendation to reduce ABC from the maximum permissible using the "constant buffer" approach (first accepted in the 2001 GOA pollock assessment). **Therefore, the ABC for 2006 based on this precautionary model configuration and adjusted harvest control rule is 62,150 mt ( $F_{ABC}=0.16$ ) for GOA waters west of 140 degrees W. longitude** (Note that this ABC recommendation is already reduced by 1,650 mt to account for the Prince William Sound GHL).

The model results produced an estimated 2006 spawning biomass of 160,670 mt, or 29% of unfished spawning biomass. The  $B_{40\%}$  estimate is 220,000 mt. Because model estimated 2007 female spawning biomass is below  $B_{40\%}$ , Gulf of Alaska pollock are in Tier 3b. The projected 2007 age-3+ biomass estimate is 833,710 mt. Markov Chain Monte Carlo analysis indicated the probability of the stock being below  $B_{20\%}$  to be less than 1% in 2006 and subsequent years. The 2006 OFL under Tier 3b is 87,220 mt ( $F_{OFL}=0.23$ ). Spawning biomass is projected to increase after 2008 in part because of the estimated above average 2004 year class, which is included in projections.

Southeast Alaska pollock are in Tier 5 and the ABC and OFL recommendations based on natural mortality (0.30) and the biomass from the 2005 survey: This results in a **2007 ABC of 6,157 t** (27,362 t \* 0.75 M), and a **2007 OFL of 8,209 t** (27,362 t \* M). Since no new survey data will be available until the summer of 2007, the 2008 ABC and OFL should be set equal to the 2007 values for the E.Yak/SE area.

The assessment was updated to include the most recent data available for area apportionments within each season (Appendix C of the GOA pollock chapter). The Team concurred with these updates since they are more likely to represent the current distribution. The author is encouraged to continue this type of research. Area apportionments, reduced by 1,650 mt for the State managed pollock fishery in Prince William Sound, are tabulated below:

Area apportionments for 2007 and 2008 pollock ABCs for the Gulf of Alaska (mt).						
Year	610	620	630	640	650	
	W	Central	Central	W. Yakutat	E.Yak/SE	Total
2007	25,012	20,890	14,850	1,398	6,157	68,307
2008	30,308	25,313	17,995	1,694	6,157	81,467

## 2. Pacific Cod

Status and catch specifications (mt) of Pacific cod and projections for 2007 and 2008. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. ABC and OFL for 2008 are projected assuming 2007 catch equals the 2007 ABC. Catch includes state managed fisheries and is current through 11/05/2006.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
GOA	2005	472,000	86,200	58,100	44,433	35,205
	2006	453,000	95,500	68,859	52,264	35,359
	2007	375,000	97,600	68,859		
	2008		86,000	71,400		

A single model was presented which was similar in structure to the model preferred last year by the Plan Teams and SSC, with Q fixed at 1.0 and M fixed at 0.37. The author noted that he intended to respond to Plan Team requests to explore alternative model structures and the incorporation of longline survey data, but that analysis was precluded by an outside review of the BSAI cod assessment which occurred during the time allotted for assessment preparation (see the GOA Plan Team minutes for further discussion on this issue). The Plan Team commends the author for completing an assessment under these difficult

circumstances. We request that the author be ensured adequate time to incorporate longline survey data and explore alternative model parameterizations in future assessments.

There were several changes in the input data:

- 1) Catch data for 2005 were updated, and preliminary catch data for 2006 were incorporated.
- 2) Size composition data from the 2005 commercial fisheries were updated, and preliminary size composition data from the 2006 commercial fisheries were incorporated.
- 3) Age composition data from the 2005 GOA bottom trawl survey were incorporated.
- 4) Parameters governing the length-at-age and weight-at-length relationships were re-estimated based on all available data from the NMFS bottom trawl survey time series.

Incorporating the new age data doubled the amount of age information in the model, and allowed the estimation of the length-at-age relationship to be done externally. This was considered an improvement over the previous internal estimation of length-at-age. Additional historical age information will be added to the assessment as it becomes available.

The current biomass in this year's assessment places the GOA Pacific cod stock in Tier 3a. Based on the model, the estimated 2007 female spawning biomass for the GOA stock is 126,903 mt, up about 9% from last year's estimate for 2006 and above the  $B_{40\%}$  value of 103,000 mt. These changes are due to the incorporation of additional age information, combined with different estimates of length at age and weight at length, which in turn reduced overall estimated recruitment variability. Less recruitment variability in turn contributes to less variability in stock size, accounting for the slightly more optimistic picture of the stock this year as opposed to last year.

Based on the model, the maximum permissible ABC (Tier 3a) for 2007 is 81,200 mt. An ABC of this magnitude would represent an increase 18%, relative to the 2006 ABC. The assessment notes that the 2001-2003 year classes are almost certainly below average, and that biomass is very likely to decrease in coming years as these cohorts work their way through the age structure. The Plan Team shares the authors' concerns regarding decreases in future biomass and the volatility in future catches that would be expected if the stock were fished at the maximum permissible rate. The author recommended ABC for 2007 is 68,859 mt, equal to the actual ABC for 2006. The Plan Team supports the author's recommended ABC for 2007 as a reasonable harvest level until further work on the assessment analysis is completed.

The Team's recommendation is to set the 2007 ABC at 68,859 mt (and 71,400 mt for 2008), corresponding to a fishing mortality rate of 0.38. The 2007 OFL under Tier 3a is estimated to be 97,600 mt (86,000 mt for 2008), corresponding to a fishing mortality rate of 0.57. The Team concurred with the author's recommendation to apportion the 2007 and 2008 ABC according to the average of biomass distribution in the three most recent surveys:

	<b>Apportionment</b>	<b>2007</b>	<b>2008</b>
West	39%	26,855	27,846
Central	55%	37,873	39,270
East	6%	4,131	4,284
Total		68,859	71,400

### 3. Sablefish

Status and catch specifications (mt) of sablefish in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2007 and 2008 are those recommended by the Plan Team. Catch data are current through 11/4/06.

Area	Year	Age 4+ Biomass	OFL	ABC	TAC	Catch
GOA	2005	185,000	19,280	15,940	15,940	13,997
	2006	152,000	17,880	14,840	14,840	12,284
	2007	158,000	16,906	14,310		
	2008		15,803	14,238		

Sablefish are assessed as a single stock in the BSAI and GOA. The present assessment departs from previous years' assessments by using a split-sex age-structured model and incorporating Gulf of Alaska trawl survey lengths and biomass estimates for depths of 500 meters or less. The split-sex model approach is appropriate given the differences in growth and maturity between males and females. Data from the trawl survey was included to improve estimates of recruitment, since trawl surveys tend to catch smaller fish than the longline survey. In addition, the assessment model incorporates the following data into the model: relative abundance and length data from the 2006 longline survey, relative abundance and length data from the 2005 longline fishery, and age data from the 2005 longline survey and longline fisheries. Fishery CPUE data from observer data and logbooks were used in the catch rate analysis. The commercial CPUE observer data were screened to exclude sets where killer whale depredation and targeting of other species occurred. Logbook data were similarly screened to account for multiple gear configurations. The results showed a good agreement between observer and logbook fishery CPUE and the survey CPUE. The survey showed a 2.5% decrease from 2004 to 2005 while the fishery abundance index decreased by 4%. The survey abundance index increased 8% from 2005 to 2006,

Spawning biomass is projected to remain stable from 2006 to 2007. The projected 2007 female spawning biomass is 38% of unfished biomass compared with about 33% of unfished biomass estimated during the 1998 to 2001 period. The recent increases are due in part to the 1997 and 2000 year classes which together are projected to account for 26% of the 2007 spawning biomass.

This stock qualifies for management under Tier 3. The updated point estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  from this assessment are 124,000 t (combined across the EBS, AI, and GOA), 0.092, and 0.11, respectively. Projected spawning biomass (combined areas) for 2007 is 118,000 t (95% of  $B_{40\%}$ ), placing sablefish in sub-tier "b" of Tier 3. The maximum permissible value of  $F_{ABC}$  under Tier 3b is 0.088, which translates into a 2007 catch (combined areas) of 20,100 t and is the Plan Team's recommended combined 2007 ABC. The recommended 2007 ABC is slightly lower than the 2006 ABC of 21,000 t. Spawning biomass is projected to remain stable through 2010. A 5-year exponential weighting of longline survey relative abundance may be used to apportion the combined 2006 ABC among regions, resulting in the following values: 2,980 t for EBS, 2,810 t for AI, and 14,310 t for GOA. Relative to 2006, apportionments to EBS and AI increased and GOA decreased.

The OFL fishing mortality rate under Tier 3b is 0.104. This fishing mortality rate translates into a 2007 OFL (combined areas) of 23,750 t. Using the survey-based apportionment scheme described above, 2007 OFL also may be apportioned among regions and results in the following values: 3,530 t for EBS, 3,320 t for AI, and 16,906 t for GOA.

Area apportionments of sablefish ABC's for 2007 and 2008					
Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2007	2,470	6,190	2,280	3,370	14,310
2008	2,458	6,159	2,269	3,353	14,238

#### 4. Flatfish

##### Deep water flatfish complex (*Dover sole and others*)

Status and catch specifications (mt) of deep water flatfish (*Dover sole and others*) and projections for 2007 and 2008. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data in this table are current through 11/04/2006.

Year	Biomass	OFL	ABC	TAC	Catch
2005	130,000	8,490	6,820	6,820	414
2006	132,460	11,008	8,665	8,665	389
2007	134,196	10,431	8,707		
2008		11,412	8,983		

##### Deep water flatfish (*excluding Dover sole*)

The deep water flatfish complex is comprised of Dover sole, Greenland turbot, and deep sea sole. Dover Sole are in Tier 3a while both Greenland turbot and deep sea sole are in Tier 6.

New data for the deep water flatfish (*excluding Dover sole*) projections from last years assessment model included the 2005 catch and estimated 2006 catch. No new assessment model was run in this off-survey year..

The Tier 6 calculation (based on average catch from 1978-1995) for the deep water flatfish complex (*excluding Dover sole*) ABC is 183 mt and the OFL is 244 mt. These values apply for 2007 and 2008 ABC and OFLs.

##### *Dover sole*

Dover sole are managed as a part of the deep water flatfish complex and an age-structured model is used for ABC recommendations.

New data for Dover sole projections from last years assessment model included the 2005 catch (407 mt) and estimated 2006 (estimated at 582 mt from last 5 year average) catch. A 5 year average was used as a conservative measure due to declining Dover sole catch in recent years. No new assessment model was run in this off survey year.

The authors' research priorities are to use alternative selectivity functions and to develop a spatially-explicit population model.

Catches remain well below the TAC. The 2007 ABC using  $F_{40\%}=0.142$  is 8,524 which is 42 mt greater than the 2006 ABC. The 2007 OFL using  $F_{35\%}=0.184$  is 10,187 mt.

The GOA Plan Team agrees with the authors' recommended ABC for the deep water flatfish complex which was equivalent to the maximum permissible ABC.

Area apportionments of deep water flatfish ( <i>Dover sole and others</i> ) ABC's for 2007 and 2008 (using $F_{40\%}$ ) are based on the fraction of the 2005 survey biomass in each area.					
Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2007	420	4,163	2,677	1,447	8,707
2008	430	4,296	2,763	1,494	8,983

*Shallow water flatfish*

Status and catch specifications (mt) of shallow water flatfish and projections for 2007 and 2008. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/04/2006.

Year	Biomass	OFL	ABC	TAC	Catch
2005	365,766	63,840	52,070	20,740	4,769
2006	365,766	62,418	51,450	19,972	7,605
2007	365,766	62,418	51,450		
2008		62,418	51,450		

The shallow water flatfish complex is made up of northern rock sole, southern rock sole, yellowfin sole, butter sole, starry flounder, English sole, sand sole, and Alaska plaice. Northern and southern rock sole are managed in Tier 4 while other shallow water flatfish are in Tier 5.

New data for the shallow water flatfish projections from last years assessment model included the 2005 catch and estimated 2006 catch. No new assessment model was run in this off survey year.

The  $F_{ABC}$  and  $F_{OFL}$  values for southern rock sole were estimated last year as:  $F_{40\%}=0.162$  and  $F_{35\%} = 0.192$ , respectively. For northern rock sole the values are:  $F_{40\%}=0.204$  and  $F_{35\%} = 0.245$ . Other flatfish ABCs were estimated with  $F_{ABC}=0.75 M$  and  $F_{OFL}=M$ .

The GOA Plan Team agrees with authors recommended ABC for the shallow water flatfish complex which was equivalent to maximum permissible ABC.

Area apportionments of shallow water flatfish ABC's for 2007 and 2008 (using  $F_{40\%}$ ) are based on the fraction of the 2005 survey biomass in each area.

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2007	24,720	24,258	628	1,844	51,450
2008	24,720	24,258	628	1,844	51,450

**5. Rex Sole**

Status and catch specifications (mt) of rex sole and projections for 2007 and 2008. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/04/2006.

Year	Biomass	OFL	ABC	TAC	Catch
2005	82,513	16,480	12,650	12,650	2,177
2006	83,475	12,000	9,200	9,200	3,380
2007	82,403	11,900	9,100		
2008		11,600	8,900		

Rex sole are assessed using an age-structured model first presented in 2004. Last year, the Plan Team adopted a Tier 5 approach (using model estimated biomass) for Rex Sole ABC recommendations due to unreliable estimates of  $F_{40\%}$  and  $F_{35\%}$ . New data in the rex sole projections from last year's assessment model included 2005 catch (2,177 mt) and estimated 2006 catch (3,280 mt). No new assessment model was run in this off survey year.

The authors' research priorities are to address high reference fishing mortality effects.

The 2007 ABC using  $F_{ABC} = 0.75M = 0.128$  is 9,100 mt which is 100 mt less than the 2006 ABC. The 2007 OFL using  $F_{OFL} = M = 0.17$  is 12,000 mt. The 2008 ABC and OFL were projected by setting 2007 catches equivalent to 2006 catches.

The GOA Plan Team agrees with authors recommended ABC for rex sole which was equivalent to maximum permissible ABC.

Area apportionments of rex sole ABC's for 2007 and 2008 (using  $F_{40\%}$ ) are based on the fraction of the 2005 survey biomass in each area.

	<b>Western</b>	<b>Central</b>	<b>West Yakutat</b>	<b>East Yakutat/SE</b>	<b>Total</b>
2007	1,147	5,446	1,037	1,470	9,100
2008	1,122	5,327	1,014	1,437	8,900

## 6. Arrowtooth flounder

Status and catch specifications (mt) of arrowtooth flounder and projections for 2007 and 2008. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data in this table are current through 11/04/2006.

<b>Year</b>	<b>Biomass</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
2005	2,109,700	253,900	216,900	38,000	19,770
2006	2,138,660	207,678	177,844	38,000	27,230
2007	2,146,360	214,828	184,008		
2008		218,020	186,763		

Arrowtooth flounder is managed under Tier 3a based on an age-structured model. No new assessment model was run in this off-survey year.

New data for arrowtooth flounder projections from last years assessment included the 2005 catch (19,770 mt) and the estimated 2006 catch (27,230 mt).

The 2007 ABC using  $F_{40\%}=0.142$  is 184,008 mt, which is 6,164 mt greater than the 2006 ABC. The 2007 OFL using  $F_{35\%}=0.168$  is 207,678 mt. The 2008 ABC and OFL were projected by setting 2007 catches equivalent to 2006 catches.

The GOA Plan Team agrees with authors recommended ABC for arrowtooth flounder which was equivalent to maximum permissible ABC.

Area apportionments of arrowtooth flounder ABC's for 2007 and 2008 (using  $F_{40\%}$ ) are based on the fraction of the 2005 survey biomass in each area.

<b>Year</b>	<b>Western</b>	<b>Central</b>	<b>West Yakutat</b>	<b>East Yakutat/SE</b>	<b>Total</b>
2007	20,852	139,582	16,507	7,067	184,008
2008	21,164	141,673	16,754	7,172	186,763

## 7. Flathead sole

Status and catch specifications (mt) of flathead sole for recent years and projections for 2007 and 2008. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data in this table are current through 11/04/2006.

<b>Year</b>	<b>Biomass</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
2005	292,099	56,500	45,100	10,390	2,530
2006	295,676	47,003	37,820	9,077	2,644
2007	297,353	48,658	39,110		
2008		51,146	41,104		

Flathead sole is managed as Tier 3a from an age-structured model. No new assessment model was run in this off-survey year.

The authors' state that research priorities include adding new age data, revising the assessment model to incorporate length-based information for selectivity estimates, and addressing environmental predictors of recruitment and catchability.

The 2007 ABC using  $F_{40\%} = 0.359$  is 39,110 mt which is 1,290 mt higher than the 2006 ABC. The 2007 OFL using  $F_{35\%} = 0.463$  is 48,658 mt. The 2008 ABC and OFL were calculated with 2007 catches equivalent to 2006 catches.

The GOA Plan Team agrees with authors recommended ABC for flathead sole which is equivalent to maximum permissible ABC.

Area apportionments of flathead sole ABC's for 2007 and 2008 (using $F_{40\%}$ ) are based on the fraction of the 2005 survey biomass in each area.					
Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2007	10,908	26,054	2,091	57	39,110
2008	11,464	27,382	2,198	60	41,104

### **Slope rockfish**

Status and catch specifications (mt) of slope rockfish management category and projections for 2007 and 2008. Projections are made using authors' estimate of 2006 and 2007 catch. Catch data in table below are current through 11/04/2006.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Pacific ocean perch	2005	286,367	16,266	13,575	13,575	11,272
	2006	312,968	16,927	14,261	14,261	13,745
	2007	315,507	17,157	14,636		
	2008		17,345	14,797		
Northern rockfish	2005	108,274	6,050	5,091	5,091	4,520
	2006	83,485	7,673	5,091	5,091	5,004
	2007	94,271	5,890	4,938		
	2008		5,660	4,748		
Shortraker rockfish	2005	32,723	982	753	753	498
	2006	37,461	1,124	843	843	628
	2007	37,461	1,124	843		
	2008		1,124	843		
Rougheye rockfish	2005	40,281	1,531	1,007	1,007	301
	2006	37,449	1,180	983	983	331
	2007	39,506	1,148	988		
	2008		1,197	993		
Other slope rockfish	2005	89,460	5,150	3,900	670	715
	2006	93,552	5,394	4,154	1,480	858
	2007	93,552	5,394	4,154		
	2008		5,394	4,154		

GOA slope rockfish are in a biennial stock assessment schedule to coincide with new survey data. This year's SAFE chapters consist of executive summaries, only northern has a full assessment. Species with age structured models have updated catch and new projections. Tier 5 species are rolled over. It is critically important to the rockfish assessments that the GOA trawl surveys continue and that they extend to 500 m in order to cover the range of primary habitat for the slope rockfish complex.

Area apportionments of ABC for slope rockfish for 2007.						
Species	Western	Central	Eastern	West Yakutat	East Yak./SE	Total
Pacific ocean perch	4,244	7,612	2,780	1,140	1,640	14,636
Northern rockfish	1,439	3,499	-	-	-	4,938
Shortraker rockfish	153	353	337	-	-	843
Rougheye rockfish	136	611	241	-	-	988
Other slope rockfish	577	386	-	319	2,872	4,154

## 8. Pacific ocean perch

Status and catch specifications (mt) of Pacific ocean perch and projections for 2007 and 2008. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. ABC and OFL for 2007 and 2008 are projected using author's estimate of 2006 and 2007 catch. Catch data are current through 11/04/2006.

Species	Year	Biomass <sup>1</sup>	OFL	ABC	TAC	Catch
Pacific ocean perch	2005	286,367	16,266	13,575	13,575	11,272
	2006	312,968	16,927	14,261	14,261	13,745
	2007	315,507	17,158	14,636		
	2008		17,345	14,797		

<sup>1</sup>Total biomass from the age-structured model

No new assessment model was run in this off-survey year. Catches were updated for 2005 and 2006 and new projections made. There was a slight increase in catch from 2005 and a 21% increase in the catch estimate for 2006. New projections yielded an ABC of 14,636, slightly less than last year's projected ABC due to increased catch in 2006. The spawning population is above  $B_{40\%}$ .

The Team and authors also concurred with the method of ABC and OFL apportionment used in the past. This results in weighting of 4:6:9 for the regional distribution biomass in the 2001, 2003, and 2005 surveys, respectively, and area apportionments of 29% for the Western area, 52% for the Central area, and 19% for the Eastern area.

Area apportionment of 2007 ABC and OFL for POP in the Gulf of Alaska:

Year		Western	Central	Eastern	WYAK	SEO	Total
2007	ABC	4,244	7,612	-	1,140	1,640	14,636
2008		4,291	7,694	-	1,153	1,659	14,797
2007	OFL	4,976	8,922	3,260			17,158
2008		5,030	9,019	3,296			17,345

Amendment 41 prohibited trawling in the Eastern area east of 140° W longitude. Since Pacific ocean perch are caught exclusively with trawl gear, there is concern that the entire Eastern area TAC could be taken in the area between 140° and 147° W longitude, that remains open to trawling. Thus, as was done last three years, the Team recommends that a separate ABC be set for Pacific ocean perch in WYAK. This weighted average is based on of the upper 95% confidence interval of the proportion of EG exploitable biomass that occurs in WYAK (0.41). The interval is computed using the weighted average from the 1999, 2003 and 2005 (2001 did not sample the Eastern Gulf). Using the upper 95% confidence interval is an effort to balance uncertainty with associated costs to industry. This corresponds to an ABC of 1,140 mt for WYAK. Under this apportionment strategy, very little of the 1,640 mt assigned to the remaining Eastern area (East Yakutat/Southeast Outside area) will be harvested.

## 9. Northern Rockfish

Status and catch specifications (mt) of northern rockfish and projections for 2007 and 2008. Projections are made using author's best estimate of 2006 and 2007 catch. Catch data in table are current through 11/04/2006.

Species	Year	Biomass <sup>1</sup>	OFL	ABC	TAC	Catch
Northern rockfish	2005	108,274	6,050	5,091	5,091	4,520
	2006	83,485	7,673	5,091	5,091	5,004
	2007	94,271	5,890	4,938		
	2008		5,660	4,748		

<sup>1</sup>Total biomass from the age-structured model.

The stock assessment author evaluated nine different model configurations. The standard deviation of normalized residuals for the fit to survey biomass was compared from model runs designed to evaluate sensitivity to model assumptions and the relative contributions of different data components. The Plan Team agreed with the authors' recommendation of Model 1 for this year's maximum permissible ABC.

This model differs from last year's model by fixing the stock recruitment relationship (rather than estimating the parameters), and by modeling selectivity as a logistic rather than smoothed penalty function. Natural mortality was estimated. The model extended back to 1961 to account for historic catch. Separate selectivities were used for the survey and fishery. New data included updated fishery age compositions for 2000 – 2002. Fishery length compositions were replaced with age compositions for the years 1998-2003. A study on maturity at age has been completed but is unavailable to the authors until the publication is released.

Based on Model 1, current female spawning biomass (30,220) is greater than  $B_{40\%}$  (22,740). The estimate of  $F_{40\%}$  is 0.062. Applying Tier 3a results in an ABC = 4,938 mt, after removing 2 mt in the Eastern Gulf and adding them to Other Slope Rockfish in West Yakutat. The overfishing level based on Tier 3a ( $F_{35\%} = 0.074$ ) is 5,890 mt.

Apportioning the 2007 and 2008 ABC is based on the same method used for Pacific ocean perch with the addition of 2 mt (included with other slope rockfish) in the West Yakutat area.

Northern rockfish ABC apportionments:

	Western	Central	Eastern	West Yakutat	East Yak./SE	Total
2007	1,439	3,499	-	-	-	4,938
2008	1,383	3,365	-	-	-	4,748

## 10. Rougheye rockfish

Status and catch specifications (mt) of rougheye rockfish and projections for 2007 and 2008. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Projections to 2007 and 2008 use author's estimate of 2006 and 2007 catch. Catch data are current through 11/04/2006.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Rougheye rockfish	2005	40,281	1,531	1,007	1,007	301
	2006	37,449	1,180	983	983	331
	2007	39,506	1,148	988		
	2008		1,197	993		

A full assessment was not done this year. Catches were updated for 2005 and 2006 and new projections were made. There was a 9% increase in catch from 2005 to 2006. New projections yielded an ABC recommendation of 988, 2 mt less than projected last year. The spawning population is above  $B_{40\%}$ .

Two appendices were attached to the executive summary: one discussing sensitivity of trawl and longline surveys and one discussing the newly described species of rougheye, *Sebastes melanostictus*. The sensitivity analysis found that artificially increasing the precision of the longline survey results in lower biomass and reducing precision in the longline survey results in minimal change to the estimated trajectory. Increasing precision in the trawl survey results in overall higher biomass and decreasing precision results in lower biomass and an emphasized step in the early 1990s when the longline survey began. The authors will pursue this analysis further for next year's assessment. The Plan Team agreed with the authors that more information is needed to evaluate whether separate management is appropriate. The two forms of rougheye overlap significantly in their distribution and they are difficult to identify morphologically.

The apportionment is 4:6:9 for the regional distribution biomass in the 2001, 2003, and 2005 surveys, respectively, and area apportionments of 29% for the Western area, 52% for the Central area, and 19% for the Eastern area.

Area apportionment (calculated using the same method as for POP) of the 2007 and 2008 ABC for rougheye rockfish in the Gulf of Alaska:

	Western	Central	Eastern	Total
2007	136	611	241	988
2008	137	614	242	993

## 11. Shortraker and other slope rockfish

### *Shortraker rockfish*

Status and catch specifications (mt) of shortraker slope rockfish and projections for 2007 and 2008. Catch data are current through 11/04/2006.

Species	Year	Biomass <sup>1</sup>	OFL	ABC	TAC	Catch
Shortraker rockfish	2005	32,723	982	753	753	498
	2006	37,461	1,124	843	843	628
	2007	37,461	1,124	843		
	2008		1,124	843		

<sup>1</sup>Exploitable biomass based on trawl surveys.

In 2006, catch increased 23% from 2005 levels. Because this is a Tier 5 species, the previous year's values are used for ABC and OFL. The recommended  $F_{ABC}$  for shortraker rockfish is 0.023 (i.e.,  $0.75 \times 0.03$ ), which results in an ABC of 843 mt. An OFL of 1,124 mt for shortraker results from applying an  $F_{OFL} = M = 0.03$ .

Area apportionment of 2007 and 2008 ABC for shortraker rockfish in the Gulf of Alaska:

Western	Central	Eastern	Total
153	353	337	843

### *Other Slope rockfish*

Status and catch specifications (mt) of the Other Slope rockfish management category and projections for 2007 and 2008. Catch data are current through 11/04/2006.

Species	Year	Biomass <sup>1</sup>	OFL	ABC	TAC	Catch
Other Slope rockfish	2005	89,455	5,150	3,900	670	715
	2006	93,552	5,394	4,154	1,480	858
	2007	93,552	5,394	4,154		
	2008		5,394	4,154		

<sup>1</sup>Exploitable biomass based on trawl surveys.

The 2006 catch increased 18% from the 2005 estimates. Because this is a Tier 5 species, the previous year's values are used for ABC and OFL.

As in the past, the Plan Team recommends setting  $F_{ABC}$  at the maximum permissible rate of  $0.75 \times M$  for "other" slope rockfish, excluding sharpchin. Applying the definitions for ABC and OFL places sharpchin rockfish in Tier 4 that allows for a maximum permissible  $F_{ABC} = F_{40\%}$ . This results in an  $F_{ABC}$  of 0.053 for sharpchin rockfish.

For "other" slope rockfish, applying the combination of  $F$  rates results in an ABC of 4,154 mt (including 2 mt of northern rockfish for West Yakutat) and an OFL of 5,394 mt.

Area apportionment of 2007 and 2008 ABC for Other Slope rockfish in the Gulf of Alaska:

	Western	Central	WYAK	SEO	Total
ABC	577	386	319	2,872	4,154

## 12. Pelagic shelf rockfish

Status and catch specifications (mt) of pelagic shelf rockfish and projections for 2007 and 2008. ABC and OFL are projected using author's estimates of catch for 2006 and 2007 for dusky rockfish. Catch data in this table are current through 11/04/2006.						
Area	Year	Biomass <sup>1</sup>	OFL	ABC	TAC	Catch
GOA	2005	65,559	5,680	4,553	4,553	2,235
	2006	97,386	6,662	5,436	5,436	2,498
	2007	99,829	6,458	5,542		
	2008		8,186	6,622		

<sup>1</sup>Based on trawl survey biomass estimates and the age structured model for dusky rockfish.

Pelagic shelf rockfish are made up of dusky rockfish (~83%) plus three other species (dark, yellowtail, and widow rockfish). Catch was updated for all species; dusky increased 7% and the other species of PSR increased 11%. New projections for dusky result in a 2007 ABC recommendation of 4,991 mt, slightly up from last year's ABC of 4,885 mt. For the other species, the values are the same as for 2006. The spawning biomass for dusky is above  $B_{40\%}$  putting them in Tier 3a whereas the others are in Tier 5.

The recommended combined 2007 ABC for all four species is 5,542 mt and the OFL is 6,458.

Apportionment of pelagic shelf rockfish is based on weighting of the NMFS trawl surveys at 4:6:9 for 2001, 2003, and 2005. Based on this weighting scheme, the percent distribution of pelagic shelf rockfish is 26% in Western, 60% in Central, and 14% in Eastern. The Eastern area is further apportioned based on the point estimate of the weighted average of the estimates of the eastern Gulf biomass proportion that is in West Yakutat (0.22). The total ABC apportionments for the pelagic shelf rockfish complex in 2006 are: Western area, 1,466 mt; Central area, 3,325 mt; West Yakutat, 307 mt, and East Yakutat/Southeast Outside, 444 mt.

Area apportionments of ABC for pelagic shelf in 2007 and 2008					
	Western	Central	W. Yakutat	E. Yakutat/SE	Total
2007	1,466	3,325	307	444	5,542
2008	1,752	3,973	366	531	6,622

### 13. Demersal shelf rockfish

Status and catch specifications (mt) of demersal shelf rockfish and projections for 2007 and 2008. Biomass for each year corresponds to the survey biomass estimates given in the SAFE report issued in the preceding year(s). 2006 catch data are current through 11/04/2006 but reflect landed catch only.

Area	Year	Biomass	OFL	ABC	TAC	Catch
GOA	2005	18,508	640	410	410	187
	2006	19,558	650	410	410	141
	2007	19,558	650	410		
	2008		650	410		

Demersal shelf rockfish have been moved to a biennial stock assessment schedule. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. There is no new stock assessment information for demersal shelf rockfish which are in Tier 4, and last year's stock assessment recommendations are rolled over for 2007 and 2008.

In response to SSC comments, information about full retention, the commercial halibut fishery DSR catch, and the recreational fishery is presented. Bycatch in the commercial halibut fishery is now estimated using depth information as well as area information from the IPHC survey and the distribution of commercial halibut catch, resulting in a lower estimate of mortality when compared to using area only information.

### 14. Thornyheads

Status and catch specifications (mt) of thornyheads and projections for 2007 and 2008. Biomass for each year corresponds to the average survey biomass estimates given in the SAFE report issued in the preceding year(s). 2006 Catch data are current through 11/04/2006.

Area	Year	Biomass	OFL	ABC	TAC	Catch
GOA	2005	86,200	2,590	1,940	1,940	719
	2006	98,158	2,945	2,209	2,209	743
	2007	98,158	2,945	2,209		
	2008		2,945	2,209		

Thornyheads have been moved to a biennial stock assessment schedule to coincide with the timing of survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. There is no new information for thornyhead rockfish which are in Tier 5, and last year's stock assessment recommendations are rolled over for 2007 and 2008.

The Team noted that for shortspine thornyhead (and a number of other species), it is critically important to the assessment that the GOA trawl surveys continue and that they extend to 500m in order to cover the range of primary habitat for this (and other) species.

Area apportionments for thornyhead ABC's are identical to last year, because there is no new survey information. Apportionments are based upon the relative distribution of biomass by area from the 2005 GOA bottom trawl survey.

Western	Central	Eastern	Total
513	989	707	2,209

## 15. *Atka mackerel*

Status and catch specifications (mt) of Atka mackerel and projections for 2007 and 2008. Biomass projections are not attempted for GOA Atka mackerel. Catch data are current through 11/04/2006.						
Area	Year	Biomass	OFL	ABC	TAC	Catch
Gulfwide	2005		6,200	600	600	799
	2006		6,200	4,700	1,500	872
	2007		6,200	4,700		
	2008		6,200	4,700		

Atka mackerel have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. There is no new information for Atka mackerel which are in Tier 6, and last year's Plan Team recommendations are rolled over for 2007 and 2008. The Plan Team noted that a 1,500 mt TAC for 2007 should be adequate to provide for incidental catch in other directed fisheries.

Age data from the 2005 GOA bottom trawl survey are presented in the executive summary. Observations of Atka mackerel in the 2005 fisheries and 2005 GOA trawl survey extended well into the GOA, and are primarily comprised of fish from the 1999 year class which has been documented as very strong year class in the Aleutian Islands Atka mackerel assessment.

There is no area apportionment for Atka mackerel. The Council manages GOA Atka mackerel on a Gulfwide basis.

## 16. *Skates*

Status and catch specifications (mt) of Skates and projections for 2007 and 2008. Average biomass for each group and area corresponds to the value given in the SAFE report issued in 2005. Catch data are current through 11/04/2006.								
Species group	Area	Average Biomass	2006				2007 and 2008	
			OFL	ABC	TAC	Catch	ABC	OFL
Big skate	W	9,273		695	695	66	695	
	C	30,005		2,250	2,250	1,146	2,250	
	E	7,982		599	599	251	599	
	<b>Total</b>	<b>47,260</b>	<b>4,726</b>	<b>3,544</b>	<b>3,544</b>	<b>1,463</b>	<b>3,544</b>	<b>4,726</b>
Longnose skate	W	868		65	65	34	65	
	C	26,255		1,969	1,969	673	1,969	
	E	11,478		861	861	139	861	
	<b>Total</b>	<b>38,601</b>	<b>3,860</b>	<b>2,895</b>	<b>2,895</b>	<b>846</b>	<b>2,895</b>	<b>3,860</b>
Bathyrāja skates	GOA wide	21,564	2,156	1,617	1,617	930	1,617	2,156

Skates have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2007 and 2008. There is no new information for skates which are in Tier 5, and last year's stock assessment ABC recommendations are rolled over for 2007 and 2008. While the assessment summary authors continued to recommend area-specific OFLs for big and longnose skates due to concerns about localized depletion and unknown stock structure, the Plan Team maintained that Gulfwide OFLs combined with the bycatch only nature of the current catch provide adequate protection, the identical recommendation to previous years.

### **Other Species**

The other species complex in the GOA contains the following species: squids, sculpins, sharks and octopus. There is no annual assessment for these species in the GOA, and ABCs and OFLs are not specified. Draft assessments for other species in the GOA are provided as appendices to this SAFE report

(see appendices B-F). These assessments will be used for the forthcoming FMP amendment analysis to evaluate the impact of establishing separate harvest specifications for the complex by species or in aggregate. The assessments were reviewed by the Plan Team and OFLs and ABCs were recommended for analytical purposes only. No specifications will be established based on these assessments until the FMP amendment is finalized.

As an interim measure, the Council took final action in June 2005 to implement a calculation change to the TAC calculation for other species (previously TAC=5% of the sum of target TACs). The 5% TAC calculation was modified such that the Council may recommend a TAC at or below 5% of the sum of the target species TACs during the annual specifications process. The Council's intent was to establish a TAC level which would meet incidental catch needs in other directed fisheries with the potential to establish this TAC at a higher level which could allow for directed fishing on the complex but be placed low enough to prevent excessive harvest of a single targeted species or on the complex as a whole. This interim measure is intended to provide additional flexibility in responding to potential conservation concerns as they arise until more comprehensive management changes can be made to the other species complex (i.e., analysis of individual species level assessments).

In order to provide the Council information to establish a TAC for the other species complex, the Plan Team discussed the incidental catch needs for directed fisheries.

Other species catch in 2005 was 2,328 mt and increased to 3,601 mt in 2006 (as of November 5, 2006). The majority of this increase was in incidental catch of squid and spiny dogfish. The team notes that the increase in catch of spiny dogfish shows an indication of a interest in a developing fishery, while the increase in squid catch is more indicative of increased incidental catch only. The squid catch was spatially and temporally limited, and was predominantly from the pollock fishery in Shelikof Strait. The Team also noted continued problems with estimating incidental catch of other species from the halibut fishery, which may constitute a significant portion of the total catch of other species in the GOA.

The Plan Team continues to be concerned about the ability for directed fishing on a single species within the other species complex up to the complex-level TAC. Similar to 2005, the Plan Team strongly encourages a TAC be established which would meet incidental catch needs (so as not to constrain directed fisheries) while providing in-season management the ability to control rapid development of directed fishing on a single member of the complex. After reviewing incidental catch needs in directed fisheries together with discussion of the potential for developing fisheries on members of the other species complex, the Plan Team believes that 4,000 mt for the complex would meet incidental catch needs and allow for exploratory fishing under the existing MRAs. Any amount set above this level would allow for additional directed fishing on the complex, and the Plan Team reiterates their concerns about the unknown impact this may impose on single species within the larger complex.

## Overview of Appendices

### ***Halibut Discard Mortality Rates***

Halibut discard mortality rates are set by the Council on a 3-year cycle for non-CDQ fisheries based on an average of the past 10 years and annually for CDQ fisheries based on available data. Halibut Discard mortality rates recommended for use in 2007-2009 are included as **Appendix A**. The Plan Team recommends adopting the listed discard mortality rates for the GOA fisheries.

### **Recommended Pacific halibut discard mortality rates (DMRs) for 2007-2009.**

<b>Gulf of Alaska</b>	
<b>Gear/Target</b>	<b>Recommendation for 2007-2009</b>
<b><i>Trawl</i></b>	
Atka mackerel	60
Bottom pollock	59
Pacific cod	63
Deepwater flatfish	53
Shallow water flatfish	71
Rockfish	67
Flathead sole	61
Pelagic pollock	76
Sablefish	65
Arrowtooth fldr	69
Rex sole	63
<b><i>Pot</i></b>	
Pacific cod	16
<b><i>Longline</i></b>	
Pacific cod	14
Rockfish	10

### ***Other Species Assessments***

Five preliminary stock assessments were reviewed by the Plan Team in conjunction with the forthcoming amendment analysis to establish separate harvest specifications for individual members of the other species complex by species or in aggregate. Recommended harvest specifications as noted below are for analytical purposes only. For many species the Team recommended a modified Tier 6 approach as described below. Final determination of alternative Tier 6 approaches is decided by the SSC. No separate specifications will be established for these species until the amendment is finalized.

See the Council website for more information on the status of the GOA other species amendment:  
[http://www.fakr.noaa.gov/npfmc/current\\_issues/non\\_target/non\\_target.htm](http://www.fakr.noaa.gov/npfmc/current_issues/non_target/non_target.htm)

### **Modified Tier 6 Approach**

As part of the other species discussions, the Plan Team reviewed and discussed alternative approaches for setting ABC and OFL under Tier 6. These alternative approaches were proposed for application to data-poor species where management under higher Tiers is not currently possible, where historical catch has been incidental only, and where there is no evidence of a conservation concern. For these data-poor species, the Team agreed that management objectives are to allow continued incidental catch at current/recent levels (preventing rapid increases in catch) without unduly restricting target fisheries. A secondary objective is to allow adequate TAC for research permits and/or experimental fisheries to improve information for stock assessment.

The proposed change to Tier 6 criteria is to substitute the maximum historical catch over a defined period for the average catch to set harvest levels. Two options were presented. In the first option, the maximum historical catch would be set equal to OFL, and ABC would be 75% of OFL. In the second option, the maximum historical catch would be set equal to ABC, and OFL would be 133% of ABC (maintaining the same ratio of the two specifications). The rationale for using either one of these modifications is that historical catch over the defined period has been entirely incidental, and this incidental catch poses no conservation concern, so the future catches should not exceed the maximum catch observed. Option 1 is more conservative and would be recommended for species where the variance in abundance is expected to be low and/or with “equilibrium” or “opportunistic” life history characteristics (e.g., late maturation, slow growth, low fecundity, high longevity). Option 2 is less conservative and would be recommended for species where the variance in abundance is expected to be high and/or with “intermittent” or “periodic” life history characteristics (e.g., early maturation, fast growing, high fecundity, short-lived).

For species with “intermittent” or “periodic” life history characteristics which are expected to be highly variable (e.g., squids), the Plan Team suggested that an even larger buffer between ABC and OFL could be implemented based on the expected variability of the stock. The rationale for this adjustment is that the ABC based on maximum observed catch during a period of incidental catch is expected to have minimal effects on the stock, so exceeding this catch by more than 33% would still fall within a range where the stock would not be overfished. For data poor species, the Plan Team suggested exploring whether potential variability in a group could be estimated using ecosystem models or other independent data sources. An upper limit to OFL could also attempt to account for predation needs within the ecosystem, if so desired.

The Team agreed that if the alternative Tier 6 specifications were implemented, close monitoring of catch and periodic evaluation of the fisheries would be necessary to ensure that catch of the group remained incidental, and that the fishery had not changed spatially or temporally in a way that would be expected to change incidental catch rates. The Team further agreed that the alternative Tier 6 approach should be applied concurrently with “bycatch only” status to ensure that directed fisheries did not develop in the absence of information. Finally, the Team agreed that experimental fishing permits or other research should be encouraged for these data-poor species by setting TAC lower than ABC to encourage the development of cooperative research.

### **Sculpins**

An assessment of sculpin species in the Gulf of Alaska (GOA) is provided in **Appendix B**. There is no directed fishery for sculpins in the GOA at this time; however, they are caught incidentally in a wide variety of fisheries, comprising approximately 19-26% of “other” species catch (2005-2006). The purpose of this assessment was to compile the available data for sculpins in the GOA and to assess future assessment needs. No specific surveys are conducted for sampling sculpins species, and severe data gaps exist in sculpin life history characteristics, spatial distribution, and abundance. There are 46 listed species, and they are broadly distributed throughout all benthic habitats from shallow to deep, over all substrate types in the GOA.

Natural mortality was estimated from the literature ( $M=0.19$ ). Unlike other taxa in the “Other” species complex, there are reliable biomass estimates for the sculpin complex. Average biomass for the sculpin complex was estimated at 30,368 mt using the three most recent surveys.

The Plan Team concurs with the authors recommendation of using a Tier 5 approach applied to the sculpin complex as long as the catch remains incidental and no target fishery develops. This results in a 2007 ABC of 4,327 t, and a 2007 OFL of 5,770 t for purposes of the forthcoming analysis.

### **Squid**

An executive summary of an assessment of squid species in the Gulf of Alaska (GOA) is provided in **Appendix C**. There is no directed fishery for squid in the GOA at this time. No specific surveys are conducted for sampling squid species, and there is limited information available for GOA squid life history characteristics, spatial distribution, and abundance.

Incidental catch of squid increased dramatically in 2006 as compared to 2005. Squid catch in 2006 increased from 626mt in 2005 to 1,526 mt in 2006. Squid catch in 2006 comprised 42% of the total other species catch, an increase from 27% of the catch in 2005. This occurred primarily in a localized area (Shelikof Strait) over a discrete time period in the pollock fishery. The biomass estimates included in the assessment represent raw survey biomass estimates and as such should be considered a minimum biomass estimates. Acoustic measures are being pursued in the Bering Sea for improved survey assessment of squid biomass. A directed squid fishery would provide additional information on the distribution of this species.

Given that trawl survey biomass estimates likely represent an underestimate of the biomass for this species, the Plan Team concurs with the assessment author that the biomass estimate is not considered reliable and the Tier 5 approach is inapplicable for this species. The Team recommended a modified Tier 6 approach for this species. Under this scenario the ABC would be set as the maximum incidental catch value from 2006 (ABC of 1,526 mt) with an OFL established incorporating an appropriate buffer above this for purposes of the forthcoming analysis.

### **Octopus**

An assessment of octopus species in the Gulf of Alaska (GOA) is provided in **Appendix D**. The purpose of this assessment was to compile the available data for octopuses in the GOA and to assess future assessment needs. Directed fishing for octopuses has been limited, but there have been recent increases in exvessel price. They are caught incidentally throughout the GOA in both state and federally-managed bottom trawl, longline, and pot fisheries. From 1997-2002 total incidental catch in federal water was between 100 and 200 mt. While some species composition, and size data are available from the NMFS bottom trawl, biomass estimates are unreliable. It is likely that the most common commercially caught species is *E. dofleini*. Life history data for all species are lacking, and at least one species is currently being described.

The Plan Team concurs with the authors recommendation of using the alternative Tier 6 approach using the maximum incidental catch as the ABC and setting OFL 33% above the ABC, as long as the catch remains incidental and no target fishery develops. This results in a suggested 2007 ABC of 298 mt, and a 2007 OFL of 398 mt for purposes of the forthcoming analysis.

### **Sharks**

An executive summary of an assessment of shark species in the Gulf of Alaska (GOA) is provided in **Appendix E**. The shark species complex in Alaska may consist of up to 10 species, however, spiny dogfish (*Squalus acanthias*), Pacific sleeper shark (*Somniosus pacificus*) and salmon sharks (*Lamna ditropis*) are by far the three most common species in the GOA. There is no directed fishery for sharks in the GOA at this time. However spiny dogfish and Pacific sleeper sharks are taken in bottom trawl and longline fisheries, but most incidentally captured sharks are not retained. This report summarizes

incidental shark catches by species as three data time series: 1990-1998, 1997-2002 and 2003-2006. Sharks have been reported by species at the NMFS AKRO since 2003 (prior to that, catch by species was estimated at the AFSC). Other time series were not directly comparable as different methods were used to estimate incidental catch. Current assessed status suggests that overfishing for sharks in the GOA is not occurring.

The authors presented three alternative assessments: Tier 5, Tier 6 using the standard average catch calculation, and a modified Tier 6 approach(option 1 as described in the “Modified Tier 6 Approach” previously). There have always been problems with applying Tier 5 and Tier 6 options to sharks in the GOA. Tier 5 criteria for establishing ABC and OFL require reliable point estimates for biomass, which do not exist for sharks in the GOA, as the efficiency of bottom trawl gear is questionable for assessing these species. Tier 5 also requires estimates of natural mortality. For the two most abundant species in the author’s data sets; spiny dogfish in GOA waters have been lacking estimates of M and are currently being addressed (see Appendix A of this assessment), and estimates of M for Pacific sleeper sharks do not exist. Tier 6 criteria require a reliable catch history from 1978-1995, which does not exist for sharks in the GOA. The modified Tier 6 approach presented is based on the premise that estimated incidental catch can be considered a known safe level of fishing. Based on this premise the maximum incidental catch can be used to set OFL for the shark complex, and the ABC would represent 75% of the OFL.

The Plan Team concurs with the author’s general recommendation that using the modified Tier 6 approach (option 1, using the maximum incidental catch for the OFL) may be the most appropriate way to proceed at this point. This would set the ABC for GOA sharks at 1,792 mt, and the OFL and 2,390 mt. These values are suggested for analytical purposes only.

### ***Grenadier***

An assessment of grenadier species is provided in an **Appendix F**. This assessment covers both the BSAI and GOA management areas. Seven species of grenadiers are known to occur in Alaska. The giant grenadier is the most abundant and has the shallowest depth distribution on the continental slope. The assessment focused on the giant grenadier as it is the most common grenadier caught in both the commercial fishery and trawl surveys.

Grenadier species are considered “non-specified” under both BSAI and GOA FMPs. As such there are no management measures implemented for this species and no official catch statistics exist. However, catches have been estimated for 1997-2005 based upon data from the North Pacific Groundfish Observer Program. Average catches in the EBS have been 3,154 mt, in the AI 2,358 mt and in the GOA 10,903 mt.

Only one age and growth study is available for giant grenadiers in the GOA and estimated a maximum age of 56 years, however the assessment author recommended that a proxy natural mortality rate be estimated based on information for Pacific grenadier instead. A subset of trawl survey biomass estimates and longline survey biomass estimates were utilized in the assessment. The Plan Team concurred with the assessment author’s recommended Tier 5 approach for this species utilizing the proxy natural mortality rate ( $M = 0.057$ ). This results in a suggested 2007 ABC of 20,889 mt and an OFL of 27,852 mt for purposes of the forthcoming analysis.

## Tables

Table 1. Gulf of Alaska groundfish 2006 - 2008 OFLs and ABCs, 2006 TACs, and 2006 catches reported through November 4, 2006.

Stock/Assemblage	Area	2006				2007		2008	
		OFL	ABC	TAC	Catch	OFL	ABC	OFL	ABC
Pollock	W (61)		29,187	29,187	24,985		25,012		30,308
	C (62)		30,775	30,775	27,155		20,890		25,313
	C (63)		18,619	18,619	17,034		14,850		17,995
	WYAK		1,809	1,809	1,572		1,398		1,694
	Subtotal	110,100	80,390	80,390	72,396	87,220	62,150	105,490	75,310
	EYAK/SEO	8,209	6,157	6,157	0	8,209	6,157	8,209	6,157
Total	118,309	86,547	86,547	72,396	95,429	68,307	113,699	81,467	
Pacific Cod	W		26,855	20,141	14,247		26,855		27,846
	C		37,873	28,405	21,091		37,873		39,270
	E		4,131	3,718	21		4,131		4,284
	Total	97,600	68,859	52,264	35,359	97,600	68,859	86,000	71,400
Sablefish	W		2,670	2,670	2,074		2,470		2,458
	C		6,370	6,370	5,467		6,190		6,159
	WYAK		2,280	2,280	1,651		2,280		2,269
	SEO		3,520	3,520	3,092		3,370		3,353
	Total	17,880	14,840	14,840	12,284	16,906	14,310	15,803	14,238
Deep-water flatfish <sup>1</sup>	W		420	420	8		420		430
	C		4,139	4,139	364		4,163		4,296
	WYAK		2,661	2,661	12		2,677		2,763
	EYAK/SEO		1,445	1,445	10		1,447		1,494
	Total	11,008	8,665	8,665	394	10,431	8,707	11,412	8,983
Rex sole	W		1,159	1,159	352		1,147		1,122
	C		5,506	5,506	2,937		5,446		5,327
	WYAK		1,049	1,049	0		1,037		1,014
	EYAK/SEO		1,486	1,486	0		1,470		1,437
	Total	12,000	9,200	9,200	3,289	11,900	9,100	11,600	8,900
Shallow-water flatfish <sup>2</sup>	W		24,720	4,500	237		24,720		24,720
	C		24,258	13,000	7,369		24,258		24,258
	WYAK		628	628	0		628		628
	EYAK/SEO		1,844	1,844	1		1,844		1,844
	Total	62,418	51,450	19,972	7,607	62,418	51,450	62,418	51,450
Flathead sole	W		10,548	2,000	462		10,908		11,464
	C		25,195	5,000	2,650		26,054		27,382
	WYAK		2,022	2,022	1		2,091		2,198
	EYAK/SEO		55	55	0		57		60
	Total	47,003	37,820	9,077	3,113	48,658	39,110	51,146	41,104
Arrowtooth flounder	W		20,154	8,000	2,011		20,852		21,164
	C		134,906	25,000	25,400		139,582		141,673
	WYAK		15,954	2,500	25		16,507		16,754
	EYAK/SEO		6,830	2,500	65		7,067		7,172
	Total	207,678	177,844	38,000	27,501	214,828	184,008	218,020	186,763

Table 1. continued.

Stock/Assemblage	Area	2006				2007		2008	
		OFL	ABC	TAC	Catch	OFL	ABC	OFL	ABC
Other slope <sup>3</sup>	W		577	577	237		577		577
	C		386	386	509		386		386
	WYAK		317	317	96		319		319
	EYAK/SEO		2,872	200	16		2,872		2,872
	Total	5,394	4,152	1,480	858	5,394	4,154	5,394	4,154
Northern rockfish <sup>3</sup>	W		1,483	1,483	970		1,439		1,383
	C		3,608	3,608	4,034		3,499		3,364
	E		0	0	0		0		0
	Total	7,673	5,091	5,091	5,004	5,890	4,938	5,660	4,747
Pacific ocean perch	W	4,931	4,155	4,155	4,199	4,976	4,244	5,030	4,291
	C	8,806	7,418	7,418	8,288	8,922	7,612	9,019	7,694
	WYAK		1,101	1,101	1,258		1,140		1,153
	SEO		1,587	1,587	0	3260	1,640	3296	1,659
	E(subtotal)	3,190	2,688	2,688	1,258	3260	2,780	3296	2,812
	Total	16,927	14,261	14,261	13,745	17,158	14,636	17,345	14,797
Shorthead	W		153	153	89		153		153
	C		353	353	291		353		353
	E		337	337	248		337		337
	Total	1,124	843	843	628	1,124	843	1,124	843
Rougheye	W		136	136	57		136		137
	C		608	608	129		611		614
	E		239	239	145		241		242
	Total	1,180	983	983	331	1,148	988	1,197	993
Pelagic shelf rockfish	W		1,438	1,438	554		1,466		1,752
	C		3,262	3,262	1,770		3,325		3,973
	WYAK		301	301	173		307		366
	EYAK/SEO		435	435	1		444		531
	Total	6,662	5,436	5,436	2,498	6,458	5,542	8,186	6,622
Demersal rockfish	SEO	650	410	410	141	650	410	650	410
Thornyhead rockfish	W		513	513	195		513		513
	C		989	989	385		989		989
	E		707	707	169		707		707
	Total	2,945	2,209	2,209	749	2,945	2,209	2,945	2,209
Atka mackerel	Total	6,200	4,700	1,500	875	6,200	4,700	6,200	4,700
Big skate	W		695	695	66		695		695
	C		2,250	2,250	1,146		2,250		2,250
	E		599	599	251		599		599
	Total	4,726	3,544	3,544	1,463	4,726	3,544	4,726	3,544
Longnose skate	W		65	65	34		65		65
	C		1,969	1,969	673		1,969		1,969
	E		861	861	139		861		861
	Total	3,860	2,895	2,895	846	3,860	2,895	3,860	2,895
Other skates	Total	2,156	1,617	1,617	930	2,156	1,617	2,156	1,617
Other Species	Total	NA	NA	13,942	3,601	NA	NA	NA	NA
<b>Total</b>		633,393	501,366	292,776	193,612	615,879	490,327	629,541	511,836

<sup>1</sup> "Deep water flatfish" includes Dover sole, Greenland turbot and deepsea sole.<sup>2</sup> "Shallow water flatfish" includes rock sole, yellowfin sole, butter sole, starry flounder, English sole, Alaska plaice, and sand sole.<sup>3</sup> The EGOA ABC of 2 mt for northern rockfish has been included in the WYAK ABC for other slope rockfish.

Table 2. Gulf of Alaska 2007 ABCs, biomass, and overfishing levels (mt) for Western, Central, Eastern, Gulfwide, West Yakutat, and Southeast Outside regulatory areas.

Species/Assemblage	2007			Overfishing Level
	Area	ABC	Biomass	
Pollock	W (61)	25,012		
	C (62)	20,890		
	C (63)	14,850		
	WYAK	1,398		
	<b>Subtotal</b>	62,150	833,710	87,220
	EYAK/SEO	6,157	27,362	8,209
	<b>Total</b>	68,307	861,072	95,429
Pacific Cod	W	26,855		
	C	37,873		
	E	4,131		
	<b>Total</b>	68,859	375,000	97,600
Sablefish	W			
	C			
	WYAK			
	EY/SEO			
	<b>Total</b>	14,310	158,000	16,906
Deep water flatfish	W	420		
	C	4,163		
	WYAK	2,677		
	EYAK/SEO	1,477		
	<b>Total</b>	8,707	134,196 <sup>4</sup>	10,431
Rex sole	W	1,147		
	C	5,446		
	WYAK	1,037		
	EYAK/SEO	1,470		
	<b>Total</b>	9,100	82,403	11,900
Shallow water flatfish	W	24,720		
	C	24,258		
	WYAK	628		
	EYAK/SEO	1,844		
	<b>Total</b>	51,450	365,766	62,418
Flathead sole	W	10,908		
	C	26,054		
	WYAK	2,091		
	EYAK/SEO	57		
	<b>Total</b>	39,110	297,353	48,658
Arrowtooth flounder	W	20,852		
	C	139,582		
	WYAK	16,507		
	EYAK/SEO	7,067		
	<b>Total</b>	184,008	2,146,360	214,828

Table 2. continued.

Species/Assemblage	2007			Overfishing Level
	Area	ABC	Biomass	
Other Slope rockfish	W	577		
	C	386		
	WYAK	319 <sup>1</sup>		
	EYAK/SEO	2,872		
	<b>Total</b>	4,154	93,552	5,394
Northern rockfish	W	1,439		
	C	3,499		
	E	0 <sup>1</sup>		
	<b>Total</b>	4,938	94,271	5,890
Pacific ocean perch	W	4,244		4,976
	C	7,612		8,922
	WYAK	1,140		
	EY/SEO	1,640		
	EGOA			3,260
<b>Total</b>	14,636	315,507	17,158	
Shorthead	W	153		
	C	353		
	E	337		
	<b>Total</b>	843	37,461	1,124
Rougheye	W	136		
	C	611		
	E	241		
	<b>Total</b>	988	39,506	1,148
Pelagic shelf rockfish	W	1,466		
	C	3,325		
	WYAK	307		
	EY/SEO	444		
	<b>Total</b>	5,542	99,829	6,458
Demersal shelf rockfish	<b>Total</b>	410	19,558	650
Thornyhead rockfish	Western	513		
	Central	989		
	Eastern	707		
	<b>Total</b>	2,209	98,158	
Atka mackerel	<b>Total</b>	4,700	Unknown	6,200
Big skates	W	695	9,273	
	C	2,250	30,005	
	E	599	7,982	
	<b>Total</b>	3,544	47,260	4,726
Longnose skates	W	65	868	
	C	1,969	26,255	
	E	861	11,478	
	<b>Total</b>	2,895	38,601	3,860
Other skates	<b>Total</b>	1,617	21,564	2,156
Other species		NA		TAC ≤5% of GF TACS
All species	<b>Total</b>	490,327	5,305,859	615,879

1/ The EGOA ABC of 2 mt for northern rockfish has been included in the WYAK ABC for other slope rockfish.

2/ Abundance relative to target stock size as specified in SAFE documents.

3/ Historically lightly exploited therefore expected to be above the specified reference point.

4/ Biomass of Dover sole; biomass of Greenland turbot and deep-sea sole is unknown.

NOTE: Overfishing is defined Gulf-wide, except for pollock and POP.

Table 3. Summary of fishing mortality rates and overfishing levels for the Gulf of Alaska, 2006.

Species	Tier	F <sub>ABC</sub> <sup>1</sup>	Strategy	F <sub>OFL</sub> <sup>2</sup>	Strategy
Pollock	3b	0.16	F <sub>ABC</sub>	0.23	F <sub>35%</sub> adjusted
Pacific cod	3a	0.38	F <sub>ABC</sub>	0.57	F <sub>35%</sub>
Sablefish	3b	0.088	F <sub>40%</sub> adjusted	0.104	F <sub>35%</sub> adjusted
Deepwater flatfish	3a,6 <sup>3</sup>	0.142	F <sub>40%</sub> , F <sub>ABC</sub> <sup>3</sup>	0.184	F <sub>35%</sub> , F <sub>OFL</sub> <sup>4</sup>
Rex sole	5	0.128	F=.75M	0.17	F=M
Flathead sole	3a	0.359	F <sub>40%</sub>	0.463	F <sub>35%</sub>
Shallow water flatfish	4,5 <sup>5</sup>	0.162-0.204	F <sub>40%</sub> , F=.75M <sup>5</sup>	0.192-0.245	F <sub>35%</sub> , F=M <sup>6</sup>
Arrowtooth	3a	0.142	F <sub>40%</sub>	0.168	F <sub>35%</sub>
Pacific ocean perch	3a	0.062	F <sub>40%</sub>	0.074	F <sub>35%</sub>
Rougheye rockfish	3a	0.039	F <sub>40%</sub>	0.047	F <sub>35%</sub>
Shortraker rockfish	5	0.023	F=.75M	0.03	F=M
Other slope rockfish	4, 5 <sup>7</sup>	0.053, 0.03-0.075	F <sub>40%</sub> , F=.75M <sup>7</sup>	0.064, 0.04-0.10	F <sub>35%</sub> , F=M <sup>8</sup>
Northern rockfish	3a	0.062	F <sub>40%</sub>	0.074	F <sub>35%</sub>
Pelagic Shelf Rockfish	3a, 5 <sup>9</sup>	0.088, 0.0525	F <sub>40%</sub> , F=.75M <sup>9</sup>	0.108, 0.07	F <sub>35%</sub> , F=M <sup>10</sup>
Demersal Shelf rockfish	4	0.02	F=M	0.032	F <sub>35%</sub>
Thornyhead rockfish	5	0.0225	F=.75M	0.03	F=M
Atka mackerel	6	NA	F <sub>ABC</sub> <sup>11</sup>	NA	F <sub>OFL</sub> <sup>12</sup>
Skates	5	0.075	F=.75M	0.10	F=M

- 1/ Fishing mortality rate corresponding to acceptable biological catch.  
 2/ Maximum fishing mortality rate allowable under overfishing definition.  
 3/ F<sub>40%</sub>= for Dover sole (Tier 3a), ABC=.75 x average catch (1978-1995) for other deepwater flatfish (Tier 6).  
 4/ F<sub>35%</sub> for Dover sole (Tier 3a), average catch (1978-1995) for other deepwater flatfish (Tier 6).  
 5/ F<sub>40%</sub> for northern and southern rocksole (Tier 4), F=.75M for remaining shallow water flatfish (Tier 5).  
 6/ F<sub>35%</sub> for northern and southern rocksole (Tier 4), F=M for remaining shallow water flatfish (Tier 5).  
 7/ F<sub>40%</sub> for sharpchin rockfish (Tier 4), F=.75M for other species (Tier 5).  
 8/ F<sub>35%</sub> for sharpchin (Tier 4), F=M for other species (Tier 5).  
 9/ F<sub>40%</sub> for dusky rockfish (Tier 3a), F=.75M for widow and yellowtail rockfish (Tier 5).  
 10/ F<sub>35%</sub> for dusky rockfish (Tier 3a), F=M for widow and yellowtail rockfish (Tier 5).  
 11/ ABC for Atka mackerel is equal to 0.75 x average catch from 1978 to 1995. This maximum permissible ABC is intended for bycatch in other target fisheries and the opportunity for a possible future experimental fishing permit.  
 12/ OFL for Atka mackerel is equal to average catch from 1978 to 1995.

Table 4. Maximum permissible fishing mortality rates and ABCs as defined in Amendment 56 to the GOA and BSAI Groundfish FMPs, and the Plan Team's 2007 recommended fishing mortality rates and ABCs, for those species whose recommendations were below the maximum. Relative to last year, northern rockfish were removed from this table since the Plan Team and the stock assessment recommended the maximum permissible F<sub>ABC</sub> value. Pacific cod was added as the Plan Team and the stock assessment recommended a rollover of the 2006 ABC.

Species	Tier	2007		2007 ABC
		Max F <sub>ABC</sub>	Max ABC	
Pollock	3b	0.19	75,150	63,800
Pacific cod	3a	0.46	81,200	68,859
Demersal shelf rockfish	4	0.026	530	410

- 1/ The Plan Team recommended 2007 W/C pollock ABC of 62,150 mt is reduced by 1,650 mt to accommodate the Prince William Sound GHL. For comparisons in this table, the maximum permissible ABC of 75,150 mt should be compared with the full ABC of 63,800 mt.

Table 5. Groundfish landings (metric tons) in the Gulf of Alaska, 1956-2006.

Year	Pollock	Pacific Cod	Sable Fish	Flat Fish	Arrowtooth Flounder	Slope Rock Fish <sup>a</sup>
1956			1,391			
1957			2,759			
1958			797			
1959			1,101			
1960			2,142			
1961			897			16,000
1962			731			65,000
1963			2,809			136,300
1964	1,126	196	2,457	1,028		243,385
1965	2,749	599	3,458	4,727		348,598
1966	8,932	1,376	5,178	4,937		200,749
1967	6,276	2,225	6,143	4,552		120,010
1968	6,164	1,046	15,049	3,393		100,170
1969	17,553	1,335	19,376	2,630		72,439
1970	9,343	1,805	25,145	3,772		44,918
1971	9,458	523	25,630	2,370		77,777
1972	34,081	3,513	37,502	8,954		74,718
1973	36,836	5,963	28,693	20,013		52,973
1974	61,880	5,182	28,335	9,766		47,980
1975	59,512	6,745	26,095	5,532		44,131
1976	86,527	6,764	27,733	6,089		46,968
1977	112,089	2,267	17,140	16,722		23,453
1978	90,822	12,190	8,866	15,198		8,176
1979	98,508	14,904	10,350	13,928		9,921
1980	110,100	35,345	8,543	15,846		12,471
1981	139,168	36,131	9,917	14,864		12,184
1982	168,693	29,465	8,556	9,278		7,991
1983	215,567	36,540	9,002	12,662		7,405
1984	307,400	23,896	10,230	6,914		4,452
1985	284,823	14,428	12,479	3,078		1,087
1986	93,567	25,012	21,614	2,551		2,981
1987	69,536	32,939	26,325	9,925		4,981
1988	65,625	33,802	29,903	10,275		13,779
1989	78,220	43,293	29,842	11,111		19,002
1990	90,490	72,517	25,701	15,411		21,114
1991	107,500	76,997	19,580	20,068		13,994
1992	93,904	80,100	20,451	28,009		16,910
1993	108,591	55,994	22,671	37,853		14,240
1994	110,891	47,985	21,338	29,958		11,266
1995	73,248	69,053	18,631	32,273		15,023
1996	50,206	67,966	15,826	19,838	22,183	14,288
1997	89,892	68,474	14,129	17,179	16,319	15,304
1998	123,751	62,101	12,758	11,263 <sup>d</sup>	12,974	14,402
1999	95,637	68,613	13,918	8,821	16,209	18,057
2000	71,876	54,492	13,779	13,052	24,252	15,683
2001	70,485	41,614	12,127	11,817	19,964	16,479
2002	49,300 <sup>f</sup>	52,270	12,246	12,520	21,230	17,128
2003	49,300	52,500	14,345	10,750	23,320	18,678
2004	62,826	43,104	15,630	7,634	15,304	18,194
2005	80,086	35,205	13,997	9,890	19,770	17,306
2006 <sup>h</sup>	72,396	45,778	12,284	14,018	27,230	20,566

a/ Catch defined as follows: (1) 1961-78, Pacific ocean perch (*S. alutus*) only; (2) 1979-1987, the 5 species of the Pacific ocean perch complex; 1988-90, the 18 species of the slope rock assemblage; 1991-1995, the 20 species of the slope rockfish assemblage.

b/ Catch from Southeast Outside District.

c/ Thornyheads were included in the other species category, and are foreign catches only.

d/ After numerous changes, the other species category was stabilized in 1981 to include sharks, skates, sculpins, eulachon, capelin (and other smelts in the family Osmeridae and octopus. Atka mackerel and squid were added in 1989. Catch of Atka Mackerel is reported separately for 1990-1992; thereafter Atka mackerel was assigned a separate target species.

Table 5. (cont'd) Groundfish landings (metric tons) in the Gulf of Alaska, 1956-2006.

Year	Pelagic Shelf Rockfish	Demersal Shelf Rockfish <sup>b</sup>	Thorny Heads <sup>c</sup>	Atka Mackerel <sup>e</sup>	Skates <sup>k</sup>	Other Species <sup>d</sup>	Total All Species
1956							1,391
1957							2,759
1958							797
1959							1,101
1960							2,142
1961							16,897
1962							65,731
1963							139,109
1964							248,192
1965							360,131
1966							221,172
1967							139,206
1968							125,822
1969							113,333
1970							84,983
1971							115,758
1972							158,768
1973							144,478
1974							153,143
1975							142,015
1976							174,081
1977			0	19,455		4,642	195,768
1978			0	19,588		5,990	160,830
1979			0	10,949		4,115	162,675
1980			1,351	13,166		5,604	202,426
1981			1,340	18,727		7,145	239,476
1982		120	788	6,760		2,350	234,001
1983		176	730	12,260		2,646	296,988
1984		563	207	1,153		1,844	356,659
1985		489	81	1,848		2,343	320,656
1986		491	862	4		401	147,483
1987		778	1,965	1		253	146,703
1988	1,086	508	2,786	-		647	158,411
1989	1,739	431	3,055	-		1,560	188,253
1990	1,647	360	1,646	1,416		6,289	236,591
1991	2,342	323	2,018	3,258		1,577	247,657
1992	3,440	511	2,020	13,834		2,515	261,694
1993	3,193	558	1,369	5,146		6,867	256,482
1994	2,990 <sup>f</sup>	540	1,320	3,538		2,752	232,578
1995	2,891	219 <sup>g</sup>	1,113	701		3,433	216,585
1996	2,302	401	1,100	1,580		4,302	199,992
1997	2,629	406	1,240	331		5,409	231,312
1998	3,111	552	1,136	317		3,748	246,113
1999	4,826	297	1,282	262		3,858	231,780
2000	3,730	406	1,307	170		5,649	204,396
2001	3,008	301	1,339	76		4,801	182,011
2002	3,318	292	1,125	85		4,040	173,554
2003	2,975	229	1,159	578		6,339	180,173
2004	2,674	260	818	819	2,912	1,559	171,734
2005	2,235	187	719	799	2,710	2,294	185,211
2006	2,498	141	743	872	3,239	3,601	193,612

e/ Atka mackerel was added to the Other Species category in 1988 and separated out in 1994

f/ PSR includes light dusky, yellowtail, widow, dark dusky, black, and blue rockfish; after 1998 black and blue were excluded.

g/ Does not include at-sea discards.

h/ Catch data reported through November 4, 2006.

i/ Includes all species except arrowtooth.

j/ Does not include state fisheries

k/ Includes all managed skates species

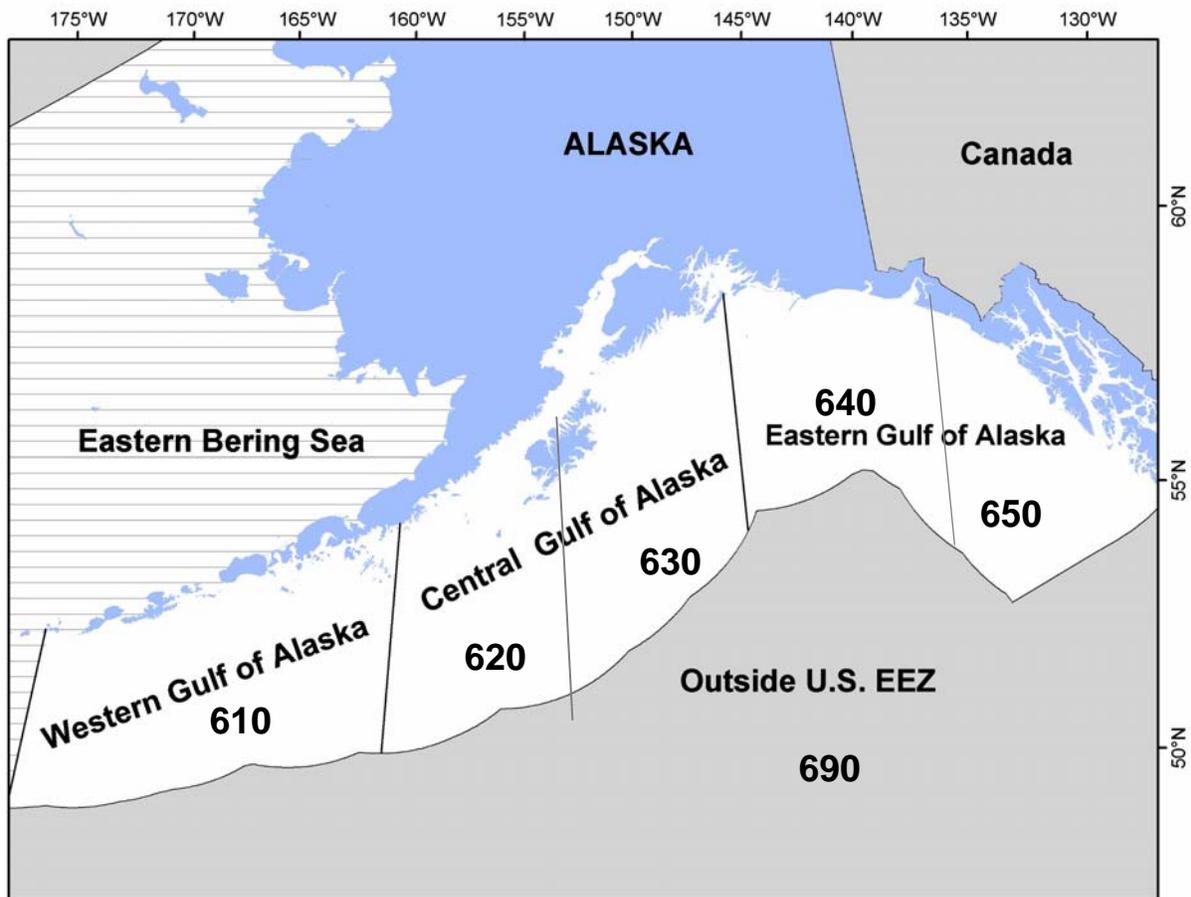


Figure 1. Gulf of Alaska statistical and reporting areas.

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